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(54) POLYESTER MOLDING MATERIAL AND ITS USE IN LASER BEAM WELDING

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a polyester molding material that is translucent to laser beam and is useful for bonding to other plastic parts including absorbable dye, pigment or filler through the laser welding technique by using formulated pigments selected from among unabsorbable pigments.
SOLUTION: This polyester molding material includes formulated pigments selected from among unabsorbable pigments. In order to surely bond this material to black-colored plastic parts, this material is preferably a molding material comprising a thermoplastic polyester, for example, polybutylene terephthalate including a black-colored formulated pigments containing a yellow pigment (preferably Sandoplast yellow) and a violet pigment (preferably Sandoplast violet). In a preferred embodiment, the content of the yellow pigment is 0.5-1.5 g per 1 kg of the plastic, while the violet pigment is 3-8 g per 1 kg of the plastic.

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(54)【発明の名称】　ポリエステル成形材料及びそのレーザー溶接における使用

(57)【要約】
【課題】　レーザー溶接法によって、プラスチックパーツを他のプラスチックパーツに結合させるのに好適な成形材料を提供すること。
【解決手段】　非吸収性顔料から作られた配合顔料を含む成形材料を用いる。

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【特許請求の範囲】

【請求項１】　非吸収性顔料から作られた配合顔料を含む成形材料。

【請求項２】　黄色顔料とバイオレット顔料との配合顔料を含む、ポリエステルと着色顔料とから作られた成形材料。

【請求項３】　存在するポリエステルが、熱可塑性ポリエステル、例えばポリエチレンテレフタレート又はポリブチレンテレフタレート又はブチレンテレフタレート単位及びブチレンイソフタレート単位由来の単位を有するコポリエステルであることを特徴とする、請求項１又は２に記載の成形材料。

【請求項４】　存在する黄色顔料がサンドプラスト・イエローであることを特徴とする、請求項１～３のいずれか１項に記載の成形材料。

【請求項５】　プラスチック１ｋｇ当たり０．１～２ｇ、好ましくは０．５～１．５ｇの量の黄色顔料を含むことを特徴とする、請求項４に記載の成形材料。

【請求項６】　存在するバイオレット顔料がサンドプラスト・バイオレットであることを特徴とする、請求項１～３のいずれか１項に記載の成形材料。

【請求項７】　プラスチック１ｋｇ当たり２～１０ｇ、好ましくは３～８ｇの量のバイオレット顔料を含むことを特徴とする、請求項６に記載の成形材料。

【請求項８】　レーザー溶接法によりプラスチックを結合させる上部半透明層を製造するために、非吸収性顔料から作られた配合顔料を含むことを特徴とする、請求項１～７のいずれか１項に記載の成形材料。

【請求項９】　レーザー溶接法によりプラスチックを結合させる上部半透明層を製造するための、請求項１～８のいずれか１項に記載の成形材料の使用。

【請求項１０】　レーザー溶接法によりプラスチックを結合させる上部半透明層を製造するための、黄色顔料とバイオレット顔料とを含むことを特徴とする、請求項１～８のいずれか１項に記載の成形材料の使用。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ポリエステルと着色顔料とから作られた成形材料、及びプラスチックを結合するためにレーザー溶接補助剤と共に使用することに関する。

【０００２】

【従来の技術】熱可塑性プラスチックのレーザー溶接は未だ広く産業界には確立していない。なぜなら、非常に高額な費用のため、潜在的ユーザーを思いとどまらせているからである。しかしながら、H.PotenteらはPlastverarbeiter No.46(1995), pp.42-46の中で、種々の応用におけるこの方法の莫大な利点を述べている。特に、将来的に接合プロセスにおいて相当の市場が予測されている（Plastverarbeiter No.48 (1997) pp.28-30参照）。

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【０００３】レーザー溶接では、通常、レーザーに対して半透明（translucent）な上部プラスチックとレーザーに対して半透明でない下部プラスチックとを結合させて、２種のプラスチックを互いに組み合わせる。ここでレーザー光線は上部プラスチック層を通過してこれを荷電していないままにし、下部層に出会い、ここで吸収されて熱エネルギーを解放する。解放された熱エネルギーはプラスチック材料を融解し、レーザー光線のあたった部分でこれを上部層と結合させる。

【０００４】しかしながら、この方法の欠点は、吸収性染料又は顔料で着色していたり、吸収性充填材を含んでいると、プラスチック材料の加工ができないということである。着色に用いられている充填材又は染料又は顔料が直ちにレーザー光線を吸収し、結合が形成されないからである。例として、カーボンブラックを用いて黒色に着色したポリエステル成形材料をここで挙げることができる。

【０００５】

【発明が解決しようとする課題】本発明の目的は、レーザー光に半透明な着色ポリエステル成形材料であって、レーザー溶接法によって、吸収性染料、顔料又は充填材を含む他のプラスチックパーツに結合させるのに好適な材料を提供することである。

【０００６】

【発明を解決するための手段】この目的は、非吸収性顔料から作られた配合顔料（a pigment combination）を含む成形材料によって達成することができた。驚くべきことに、新規成形材料は非吸収性顔料を含む。この方法を、着色プラスチックパーツを他の着色あるいは黒色プラスチックパーツに結合するために用いることができることは意外である。黒色プラスチックパーツに確実に結合させるために、成形材料は黄色顔料を含むことが好ましい。黒色プラスチックパーツに確実に結合させるために、成形材料は黄色顔料とバイオレット顔料とを含むことが特に好ましい。黄色顔料とバイオレット顔料との使用によってポリエステル成形材料に黒の色調（shade）が生じた状態で用いられることが特に非常に好ましい。

【０００７】

【発明の実施の形態】本発明によると、用いられるポリエステル材料は、少なくとも１の芳香族ジカルボン酸のエステル、特にテレフタル酸、イソフタル酸又は２，６－ナフタレンジカルボン酸及び少なくとも１の脂肪族ジオール、特にエチレングリコール、１，３－プロパンジオール又は１，４－ブタンジオールあるいはテトラヒドロフランの重合単位を含むものから誘導される重合単位を有する熱可塑性ポリエステルを含む。本発明に好適なポリエステルの例としては、Ullmann's Encyclopedia of Ind. Chem.,ed. Barbara Elvers, Vol.A24, Polyester section (pp.227-251)VCH Weinheim-Basel-Cambrige-New York (1992)に記載されている。本発明によると、

特に好適なものとして、例えばポリエチレンテレフタレート又はポリブチレンテレフタレート及びブチレンテレフタレート単位とブチレンイソフタレート単位とを有するコポリエステルなどが挙げられる。

【０００８】ポリエステルは、縮合中に、少量の脂肪族ジカルボン酸、例えばグルタル酸、アジピン酸又はセバシン酸、あるいはポリグリコール、例えばジエチレングリコール又はトリエチレングリコール、あるいは他の高分子量ポリエチレングリコールを導入することにより改質してもよい。ポリエステルは、ヒドロキシカルボン酸、好ましくはヒドロキシ安息香酸又はヒドロキシナフタレンカルボン酸から誘導される他の重合単位を有していてもよい。

【０００９】ポリエステルは、新たに調製されたポリエステルの他、一次、二次、又は高次リサイクル材料を含んでいてもよく、あるいは新たに調製されたポリエステルとリサイクル材料との混合物であってもよい。かかるタイプの混合物は、所望により、添加剤を含んでいてもよく、あるいは他の相溶可能なポリマーを混ぜて改質してもよい。

【００１０】本発明の目的のためには、黄色顔料は、特にサンドプラスト・イエロー（Sandoplast Yellow）、キノフタロン群の染料から誘導される顔料である。サンドプラスト・イエロー－２Ｇは色価「S.V.114=Solvent Yellow 114」を示す。

【００１１】本発明の目的のためには、バイオレット顔料は、特にサンドプラスト・バイオレット（Sandoplast Violet）、アントラキノン群の染料から誘導される顔料である。サンドプラスト・バイオレット－ＲＳＢは色価「S.V.13=Solvent Violet 13」を示す。

【００１２】かかるタイプのサンドプラスト系染料は、多種のプラスチックの着色に好適な、概して高品質ポリマー溶解性染料である。ポリスチレンで標準化され、あでやかで透明な彩色を与える。白色顔料、例えば、二酸化チタン又は硫化亜鉛を加えることにより不透明な処方＊

＊を達成することができる。他の有機又は無機顔料との組み合わせにより、さらに強い着色とさらにあでやかな彩色を与える。特にあでやかな色相を達成するために、サンドプラスト系染料を蛍光剤ホスタゾル（Hostasol）系染料と共に用いることができる。

【００１３】本発明の黄色顔料の好適な量は、プラスチック１ｋｇ当たり０．１～２ｇ、好ましくは０．５～１．５ｇである。本発明のバイオレット顔料の好適な量は、プラスチック１ｋｇ当たり２～１０ｇ、好ましくは３～８ｇである。

【００１４】驚くべきことに配合顔料を有する本発明の成形材料は、裸眼では黒色に見えても完全にレーザー光に半透明であり、従ってレーザー溶接法のための上部半透明相を製造するのに非常に好適である。

【００１５】以下の実施例は、熟練した労働者にさらに詳細な発明の説明と、それにより達成可能な利益を提供することを目的とする。

【００１６】

【実施例】比較実施例１

プラスチック１ｋｇ当たり６．５ｇの量のカーボンブラックを添加したポリブチレンテレフタレート製の２つの黒色フィルムを、押し出しにより製造し、各フィルムとも厚さは４０μｍであった。２つのフィルムを、１のフィルムを他方のフィルムの上に載せて置き、NdYAGレーザー光線を３秒間照射してた。照射後、上部フィルムが融解していたが、２つのフィルムにはいかなる結合もなかった。

【００１７】実施例１

用いる上部フィルムを、プラスチック１ｋｇ当たりサンドプラスト・イエロー０．９ｇとサンドプラスト・バイオレット５．１ｇとから作られた黒色の外観の配合顔料を有するポリブチレンテレフタレートとすること以外は比較実施例１を繰り返した。比較実施例１と同様の間、同様のレーザー光線を照射した後、２つのフィルムの間には強固な結合が形成された。

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【外国語明細書】

1 Title of Invention

Polyester molding composition and its use for laser welding

2 Claims

1. A molding composition comprising a pigment combination made from nonabsorbing pigments.

2. A molding composition made from polyester with color pigments, which comprises a pigment combination of yellow pigment and violet pigment.

3. A molding composition as claimed in claim 1 or 2, in which the polyesters present are thermoplastic polyesters, such as polyethylene terephthalate or polybutylene terephthalate or copolyesters having units derived from butylene terephthalate units and butylene isophthalate units.

4. A molding composition as claimed in any of claims 1 to 3, in which the yellow pigment present comprises Sandoplast Yellow.

5. A molding composition as claimed in claim 4, which comprises an amount of from 0.1 to 2 g, preferably from 0.5 to 1.5 g, of yellow pigment per kg of plastic.

6. A molding composition as claimed in any of claims 1 to 3, in which the violet pigment present comprises Sandoplast Violet.

7. A molding composition as claimed in claim 6, which comprises an amount of from 2 to 10 g, preferably from 3 to 8 g, of violet pigment per kg of plastic.

8. A molding composition as claimed in any of claims 1 to 7, comprising a pigment combination made from nonabsorbing pigments for producing the upper translucent layer for bonding plastics by the laser welding method.

9. The use of a molding composition as claimed in any one of claims 1 to 8 for producing the upper translucent layer for bonding plastics by the laser welding method.

10. The use of a molding composition as claimed in any of claims 1 to 8, comprising a yellow pigment and a violet pigment, for producing the upper translucent layer for bonding plastics by the laser welding method.

3 Detailed Description of Invention

The invention relates to a molding composition made from polyester with color pigments and its use for bonding thermoplastics with the aid of laser welding.

Laser welding of thermoplastics has not yet become widely established in industry, since high capital expenditure deters potential users. However, H. Potente et al. in Plastverarbeiter No. 46 (1995), pp. 42 - 46, describes the enormous advantages of this process in various applications. In particular a considerable potential market is forecast for the jointing process in the future (see Plastverarbeiter No. 48 (1997) pp. 28 - 30).

In laser welding two plastics are normally combined with one another by bonding an upper plastic translucent to laser light with a lower plastic not translucent to laser light. The laser beam here passes through the upper layer of plastic leaving it unchanged and encounters the lower layer, by which it is absorbed with liberation of thermal energy. The thermal energy liberated melts the plastic material and thus bonds it to the upper layer at the point of impact of the laser beam.

A disadvantage of this method, however, is that it is not possible to process plastic compositions pigmented with absorbing dyes or pigments or comprising absorbing fillers, since the filler or dye or, respectively, the pigment used for coloration always immediately absorbs the laser light so that no bond is produced.
An example which may be mentioned here is that of polyester molding compositions pigmented black using carbon black.

The object of the present invention was to provide a colored polyester molding composition which is translucent to laser light and which therefore is suitable for bonding by the laser welding method to other plastic parts comprising absorbing dyes, pigments or fillers.

This object has been achieved by a molding composition comprising a pigment combination made from nonabsorbing pigments.

Surprisingly, the novel molding composition comprises nonabsorbing pigments.
It is surprising that this method can be used to bond colored plastic parts to other colored or black plastic parts.
It is preferable for a molding composition which comprises yellow pigment to be secured on black plastic parts.
It is particularly preferable for a molding composition comprising yellow pigment and violet pigment to be secured on black plastic parts.
It is very particularly preferable for a polyester molding composition to be used in which a shade of black has been brought about by the use of a yellow pigment and a violet pigment.

According to the invention the polyester materials used comprise thermoplastic polyesters which contain polymerized units deriving from an ester of at least one aromatic dicarboxylic acid, in particular from terephthalic acid, isophthalic acid or 2,6-naphthalenedicarboxylic acid and from at least one aliphatic diol, in particular ethylene glycol 1,3-propanediol or 1,4-butanediol, or which contain polymerized units of tetrahydrofuran. Examples of suitable polyesters according to the invention are described in Ullmann's Encyclopedia of Ind. Chem., ed. Barbara Elvers, Vol. A24, Polyester section (pp. 227 - 251) VCH Weinheim-Basel-Cambridge-New-York (1992). According to the invention particular preference is given to polyesters such as polyethylene terephthalate or polybutylene terephthalate and to copolyesters containing butylene terephthalate units and butylene isophthalate units.

The polyesters may also have been modified by incorporating, during the condensation, small amounts of aliphatic dicarboxylic acids, such as glutaric acid, adipic acid or sebacic acid, or of polyglycols, such as diethylene glycol or triethylene glycol, or else higher-molecular-weight polyethylene glycols. The polyesters may also contain other polymerized units derived from hydroxycarboxylic acids, preferably from hydroxybenzoic acid or from hydroxynaphthalenecarboxylic acid.

Besides freshly prepared polyester the polyesters may also comprise first-, second- or higher-generation recycled materials, or mixtures of freshly prepared polyester with recycled materials. Mixtures of this type may also, if desired, comprise additives, or may have been modified by admixing other compatible polymers.

For the purposes of the invention, yellow pigment is in particular Sandoplast Yellow, a pigment deriving from the chinophthalone group of dyes. Sandoplast Yellow - 2 G is indicated in the color index under "S.V. 114 = Solvent Yellow 114".

For the purposes of the invention, violet pigment is in particular Sandoplast Violet, a pigment deriving from the anthrachinone group of dyes. Sandoplast Violet - RSB is indicated in the color index under "S.V. 13 = Solvent Violet 13".

Sandoplast dyes of this type are generally high-quality polymer-soluble dyes which are suitable for coloring a variety of plastics. They are standardized in polystyrene, in which they give a brilliant and transparent coloration. Opaque formulations can be achieved by adding white pigments, such as titanium dioxide or zinc sulfide. Combinations with other organic or inorganic pigments give more intensely colored and more brilliant colorations. Sandoplast dyes can be used together with fluorescent Hostasol dyes to achieve especially brilliant hues.

The amount of yellow pigment suitable according to the invention is from 0.1 to 2 g, preferably from 0.5 to 1.5 g, per kg of plastic.

The amount of violet pigment suitable according to the invention is from 2 to 10 g, preferably from 3 to 8 g, per kg of plastic.

Surprisingly, it has been found that the molding composition with the pigment combination according to the invention, although it looks black to the naked eye, is completely translucent to laser light and is therefore highly suitable for producing the upper translucent layer for the laser welding process.

The working example below is intended to give the skilled worker a more detailed description of the invention and the advantages achievable therewith.

Comparative Example 1

Two black films made from polybutylene terephthalate with an added amount of 6.5 g of carbon black per kg of plastic were produced by extrusion and had in each case a thickness of 40 µm. The two films were laid one on top of the other and irradiated with a laser beam from a NdYAG laser for a period of 3 s.

After the irradiation the surface of the upper film had melted, but there had been no bonding of the two films.

Example 1

Comparative Example 1 was repeated except that the upper film used a polybutylene terephthalate with a pigment combination of black appearance, made from 0.9 g of Sandoplast Yellow and 5.1 g Sandoplast Violet per kg of plastic.

After the same period of irradiation as in Comparative Example 1, using an identical laser beam, a firmly adhering bond had developed between the two films.

1 **Abstract**

The invention relates to a polyester molding composition comprising nonabsorbing pigments and its use for laser welding.

2 **Representative Drawing**
none

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(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a polyester molding material that is translucent to laser beam and is useful for bonding to other plastic parts including absorbable dye, pigment or filler through the laser welding technique by using formulated pigments selected from among unabsorbable pigments.
SOLUTION: This polyester molding material includes formulated pigments selected from among unabsorbable pigments. In order to surely bond this material to black-colored plastic parts, this material is preferably a molding material comprising a thermoplastic polyester, for example, polybutylene terephthalate including a black-colored formulated pigments containing a yellow pigment (preferably Sandoplast yellow) and a violet pigment (preferably Sandoplast violet). In a preferred embodiment, the content of the yellow pigment is 0.5-1.5 g per 1 kg of the plastic, while the violet pigment is 3-8 g per 1 kg of the plastic.

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The molding material containing the combination pigment made from the unabsorbent pigment.
[Claim 2] The molding material containing the combination pigment of a yellow pigment and a violet pigment made from polyester and a color pigment.
[Claim 3] The molding material according to claim 1 or 2 characterized by the existing polyester being copoly ester which has thermoplastic polyester, for example, polyethylene terephthalate, polybutylene terephthalate or a butylene terephthalate unit, and the unit of the butylene isophthalate unit origin.
[Claim 4] A molding material given in any 1 term of claims 1-3 characterized by the existing yellow pigment being sand PURASUTO yellow.
[Claim 5] It is the molding material according to claim 4 characterized by 0.1-2g per plastics 1kg of things preferably included for the yellow pigment of an amount (0.5-1.5g).
[Claim 6] A molding material given in any 1 term of claims 1-3 characterized by the existing violet pigment being sand PURASUTO violet.
[Claim 7] It is the molding material according to claim 6 characterized by 2-10g per plastics 1kg of things preferably included for the violet pigment of an amount (3-8g).
[Claim 8] A molding material given in any 1 term of claims 1-7 characterized by including the combination pigment made from the unabsorbent pigment in order to manufacture the up translucent layer which combines plastics by the laser-beam-welding method.
[Claim 9] Use of a molding material given in any 1 term of claims 1-8 for manufacturing the up translucent layer which combines plastics by the laser-beam-welding method.
[Claim 10] Use of a molding material given in any 1 term of claims 1-8 characterized by including the yellow pigment and violet pigment for manufacturing the up translucent layer which combines plastics by the laser-beam-welding method.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to using it with a laser-welding adjuvant, in order to combine the molding material made from polyester and a color pigment, and plastics.
[0002]
[Description of the Prior Art] Laser welding of thermoplastics is not yet widely established in the industrial world. It is because the potential user is made to abandon because of very large sum costs. However, H.Potente and others has described the immense advantage of this approach in various application in Plastverarbeiter No.46 (1995) and pp.42-46. Especially, the considerable commercial scene will be predicted in the junction process in the future (Plastverarbeiter No.48 (1997) pp.28 -30 reference).
[0003] In laser welding, the lower plastics which is not translucent is combined to translucent (translucent) up plastics and laser to laser, and two sorts of plastics is usually combined mutually. A laser beam passes an up plastics layer, electric-charge-keeps this not carried out, meets with a lower layer, is absorbed here, and releases heat energy here. The released heat energy dissolves plastic material and this is combined with an up layer in the part equivalent to which the laser beam was.
[0004] However, when the absorptivity color or the pigment is coloring or the fault of this approach contains the absorptivity filler, I hear that it cannot perform processing of plastic material, and there is. It is because the filler, color, or pigment used for coloring absorbs a laser beam immediately and association is not formed. The polyester molding compound colored black, using carbon black as an example can be mentioned here.
[0005]
[Problem(s) to be Solved by the Invention] The purpose of this invention is a coloring polyester molding compound translucent in laser light, and is offering the suitable ingredient for making it combine with other plastics parts which contain an absorptivity color, a pigment, or a filler with laser welding process.
[0006]
[The means for solving invention] The molding material containing the combination pigment (a pigment combination) made from the unabsorbent pigment was able to attain this purpose. A new molding material contains an unabsorbent pigment in a surprising thing. It is unexpected that this approach can be used in order to combine colored plastic parts with other coloring or black plastics parts. In order to make it combine with black plastics parts certainly, as for a molding material, it is desirable that a yellow pigment is included. In order to make it combine with black plastics parts certainly, especially the thing of a molding material containing a yellow pigment and a violet pigment is desirable. It is very desirable especially to be used for a polyester molding compound by use with a yellow pigment and a violet pigment, after the black color tone (shade) has arisen.
[0007]
[Embodiment of the Invention] According to this invention, the polyester ingredient used contains the thermoplastic polyester which has the polymerization unit guided from a thing including the polymerization unit of ester [of the aromatic series dicarboxylic acid of at least 1] especially terephthalic-acid, isophthalic acid or 2, and 6-naphthalene dicarboxylic acid and the aliphatic series diol of at least 1 especially ethylene glycol, 1,3-propanediol, 1,4-butanediol, or a tetrahydrofuran. It is indicated by Ullmann's Encyclopedia of Ind.Chem., ed.Barbara Elvers, Vol.A24, and Polyester section VCH Weinheim-Basel-Cambrige-New York (pp.227-251) (1992) as an example of the suitable polyester for this invention. According to this invention, the copoly ester which has polyethylene terephthalate or polybutylene terephthalate and a butylene terephthalate unit, and a butylene isophthalate unit is especially mentioned as a suitable thing.

[0008] Polyester may be reformed by introducing little aliphatic series dicarboxylic acid, for example, a glutaric acid, an adipic acid, a sebacic acid, polyglycol, for example, a diethylene glycol, triethylene glycol, or other amount polyethylene glycols of giant molecules into condensation. Polyester may have hydroxycarboxylic acid and other polymerization units preferably guided from a hydroxybenzoic acid or a hydroxy naphthalene carboxylic acid.
[0009] Polyester may be the mixture of the polyester and the recycle ingredient which may contain others, primary, secondary, or a high order recycle ingredient, or were newly prepared. [polyester / which was newly prepared] By request, this type of mixture may contain the additive, or may mix and reform the polymer in which other compatibility is possible.
[0010] It is the pigment with which especially a yellow pigment is guided from the color of sand PURASUTO yellow (Sandoplast Yellow) and a kino FUTARON group for the purpose of this invention. Sand PURASUTO yellow-2G show a color number "S. V.114=Solvent Yellow 114."
[0011] It is the pigment with which especially a violet pigment is guided from the color of sand PURASUTO violet (Sandoplast Violet) and an anthraquinone group for the purpose of this invention. Sand PURASUTO violet - RSB shows a color number "S. V.13=Solvent Violet 13."
[0012] this type of sand PURASUTO system color is suitable for coloring of various plastics -- it is a high quality polymer solubility color generally. It standardizes with polystyrene and fascinating and transparent coloring is given. An opaque formula can be attained by adding white pigments, for example, a titanium dioxide, or zinc sulfide. With organic [other] or combination with an inorganic pigment, still stronger coloring and still more fascinating coloring are given. In order to attain a fascinating hue especially, a sand PURASUTO system color can be used with a fluorescence agent HOSUTAZORU (Hostasol) system color.
[0013] 0.1-2g per plastics 1kg of suitable amounts of the yellow pigment of this invention is 0.5-1.5g preferably. 2-10g per plastics 1kg of suitable amounts of the violet pigment of this invention is 3-8g preferably.
[0014] Even if the molding material of this invention which has a combination pigment in a surprising thing looks black in the naked eye, it is completely translucent in laser light, therefore it is very suitable to manufacture the up translucent phase for a laser-welding method.
[0015] The following examples aim at providing the skilled laborers with explanation of still more detailed invention, and the profits which can be attained by that cause.
[0016]
[Example] Two black films made from polybutylene terephthalate which added carbon black with an amount of 6.5g [per comparison example 1 plastics 1kg] were manufactured by extrusion, and each film of thickness was 40 micrometers. The film of 1 was carried on the film of another side, two films were placed, and the NdYAG laser beam was irradiated for 3 seconds. After the exposure, although the up film was dissolving, any association could not be found in two films.
[0017] The comparison example 1 was repeated except considering as the polybutylene terephthalate which has the combination pigment of a black appearance made from sand PURASUTO yellow 0.9g and sand PURASUTO violet 5.1g per plastics 1kg in the up film used example 1. While being the same as that of the comparison example 1, after irradiating the same laser beam, firm association was formed between two films.

[Translation done.]